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%This is embodiment #1
%Programmer: Carlos E. Davila
%programmer: Carlos E. Davila
%Dept. of Electrical Engineering, Southern Methodist University
%date of last modification: 12/7/99
clear;
randn('state',0);
lam1 = 0.8;
lam0 = 0.8;
N = 16;
r = 4;
T_max = N*2000;
x(1:T_max/2) = cos(0.35*pi*[1:T_max/2]) + ...
    cos(0.78*pi*[1:T_max/2] + 0.35*pi);
x(T_max/2+1:T_max) = cos(0.6*pi*[1:T_max/2]) + ...
    cos(0.8*pi*[1:T_max/2] + 0.35*pi);

x1_rec = [];
x_hat_rec = [];
ntr = 1;
b = 8;
for itr = 1:ntr,

    itr
    sig_n = 0.0001;

    x_max = max(x);
    x_min = min(x);
    del = (x_max - x_min)/b;
    Ro = eye(N)*0.001;
    U=randn(N,4);
    U=orth(U);
    q_3 = U(:,4);
    q_2 = U(:,3);
    q_1 = U(:,2);
    q_0 = U(:,1);
    x_0 = x(N*(itr-1)+1:N*itr)';
    x_0 = x_0 - mean(x_0);

    Q_hat = real([q_3 q_2 q_1 q_0]);

    R_hat = eye(N)*0.001;

    %for it = 2:50,
    for it = 1:2000,
        if rem(it,100) == 0
            [it err(it-1)]
        end

        x_0 = x(N*(it-1)+1:N*it)';
        %x_0 = x_0 - mean(x_0);
        v_0 = randn(N,1);

        Ro = lam0*Ro + x_0*x_0';
        [Vo Do] = eig(Ro);
        Do = diag(Do);
        [Do Io] = sort(Do);
        q_0o = Vo(:,Io(N));
        q_1o = Vo(:,Io(N-1));
        q_2o = Vo(:,Io(N-2));
        q_3o = Vo(:,Io(N-3));

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Qo_hat = [q_0o q_1o q_2o q_3o];

%Q1 = [Q_hat v_0];
%xh = floor(x_0/del)*del;
%xh = v_0 - Q_hat*Q_hat'*v_0;
%xh = xh/norm(xh);
%Q1 = [Q_hat sign(x_0)];

Q1 = [Q_hat v_0];
A = lam1*Q1'*R_hat*Q1 + Q1'*x_0*x_0'*Q1;
B = Q1'*Q1;
[V D] = eig(A,B);
%[V D] = eig(A);
D = diag(D);

for n = 1:5
    if abs(imag(D(n))) > 0.001
        D(n) = 0;
    end
end
[Ds I] = sort(D);
% alpha = [V(:,I(6)) V(:,I(5)) V(:,I(4)) V(:,I(3))];
alpha = real([V(:,I(5)) V(:,I(4)) V(:,I(3)) V(:,I(2))]);
Beta = Q1*alpha;
%Beta = Q*V;
q_0 = Beta(:,1);
q_1 = Beta(:,2);
q_2 = Beta(:,3);
q_3 = Beta(:,4);
x_hat = Q_hat*Q_hat'*x_0;
Q_hat = [q_0/norm(q_0) q_1/norm(q_1) q_2/norm(q_2) q_3/norm(q_3)];

Q_hat = Q_hat + flipud(Q_hat);
Q_hat = orth(Q_hat);

%R_hat = Q_hat*diag(flipud(Ds(2:5)))*Q_hat' + eye(N)*Ds(1);
R_hat = Q_hat*diag(flipud(Ds(2:5)))*Q_hat' + eye(N)*Ds(1);
P_Q = Q_hat*inv(Q_hat'*Q_hat)*Q_hat';

P_Qo = Qo_hat*inv(Qo_hat'*Qo_hat)*Qo_hat';
errq(it) = norm(P_Q - P_Qo,'fro');
x_hat_rec = [x_hat_rec x_hat'];
err(it) = norm(x_0 - x_hat)^2;

% end
end
end%itr

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%This is embodiment #2
%programmer: Carlos E. Davila
%Dept. of Electrical Engineering, Southern Methodist University
%date of last modification: 12/9/99
clear;
lam1 = 0.7;
lam0 = 0.7;
N = 32;
T_max = N*2000;
x(1:T_max/2) = cos(0.3*pi*[1:T_max/2]) + ...
    cos(0.7*pi*[1:T_max/2] + 0.35*pi);
x(T_max/2+1:T_max) = cos(0.6*pi*[1:T_max/2]) + ...
    cos(0.8*pi*[1:T_max/2] + 0.35*pi);

x1_rec = [];
x_hat_rec = [];
ntr = 1;
b = 8;
for itr = 1:ntr,

    itr
    sig_n = 0.0001;

    x_max = max(x);
    x_min = min(x);
    del = (x_max - x_min)/b;
    Ro = eye(N)*0.001;
    U=randn(N,4);
    U=orth(U);
    q_3 = U(:,4);
    q_2 = U(:,3);
    q_1 = U(:,2);
    q_0 = U(:,1);
    x_0 = x(N*(itr-1)+1:N*itr)';
    x_0 = x_0 - mean(x_0);

    Q_hat = real([q_3 q_2 q_1 q_0]);
    R_hat = eye(N)*0.001;
    v_0 = randn(N,1000);

    %for it = 2:50,
    for it = 1:2000,
        if rem(it,100) == 0
            [it err(it-1)]
        end

        x_0 = x(N*(it-1)+1:N*it)';
        %x_0 = x_0 - mean(x_0);

        Ro = lam0*Ro + x_0*x_0';
        [Vo Do] = eig(Ro);
        Do = diag(Do);
        [Do Io] = sort(Do);
        q_0o = Vo(:,Io(N));
        q_1o = Vo(:,Io(N-1));
        q_2o = Vo(:,Io(N-2));
        q_3o = Vo(:,Io(N-3));
        Qo_hat = [q_0o q_1o q_2o q_3o];

        pow_max = 0;

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        for m = 1:1000
            xh = v_0(:,m);

            Q1 = [Q_hat xh];

            A = lam1*Q1'*R_hat*Q1 + Q1'*x_0*x_0'*Q1;
            B = Q1'*Q1;
            [Vr Dr] = eig(A,B);
            Dr = diag(Dr);

            for n = 1:5
                if abs(imag(Dr(n))) > 0.001
                    Dr(n) = 0;
                end
            end
            [Drs Ir] = sort(Dr);
            pow = sum(Drs(2:5));
            if pow > pow_max
                pow_max = pow;
                V = Vr;
                I = Ir;
                Ds = Drs;
                v_n = xh;
            end
        end% m

%       alpha = [V(:,I(6)) V(:,I(5)) V(:,I(4)) V(:,I(3))];
%       alpha = [V(:,I(5)) V(:,I(4)) V(:,I(3)) V(:,I(2))];
%       Q1 = [Q_hat v_n];

        Beta = Q1*alpha;
        %Beta = Q*V;
        q_0 = Beta(:,1);
        q_1 = Beta(:,2);
        q_2 = Beta(:,3);
        q_3 = Beta(:,4);
        Q_hat = [q_0/norm(q_0) q_1/norm(q_1) q_2/norm(q_2) q_3/norm(q_3)];
        x_hat = Q_hat*Q_hat'*x_0;
        R_hat = Q_hat*diag(flipud(Ds(2:5)))*Q_hat' + eye(N)*Ds(1);
        P_Q = Q_hat*inv(Q_hat'*Q_hat)*Q_hat';

        P_Qo = Qo_hat*inv(Qo_hat'*Qo_hat)*Qo_hat';
        %err(it) = norm(P_Q - P_Qo,'fro')/ntr;
        x_hat_rec = [x_hat_rec x_hat'];
        err(it) = norm(x_0 - x_hat)^2;
        [it err(it)]
    % end
end
end%itr

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%This is embodiment #4
%Programmer: Carlos E. Davila
%programmer: Carlos E. Davila
%Dept. of Electrical Engineering, Southern Methodist University
%date of last modification: 11/10/00
clear;
randn('state',0);
lam1 = 0.995;
sample_rate = 8000;
mse_max = 0.9e-2;
%mse_max = 5e-2;
N = 64;
M = 1024;
r = N;
T_max = N*2000;
%load x
load s18
%load err_s18;
%load m9
%x = err_s18';

x = x'/norm(x)*33.5326;

%wc = 0.6;
%h = [sin(wc*pi*[-16:16])./([-16:16]*pi)];
%h(17) = wc;
%x = filter(h,1,x);

bitrate = 0;
eval_min = 25e-3;
b_min = 3;
max_repeats = 2;
rep_rate = 6;
rate_0 = 4;
k_max = floor(N/2)+1;
k_max = N;
nstd = 6;
b = rate_0*ones(1,k_max);
x_fs_0 = 4*ones(1,k_max);

Do = 10*ones(1,N);
% x(1:T_max/2) = cos(0.35*pi*[1:T_max/2]) + ...
%       cos(0.78*pi*[1:T_max/2] + 0.35*pi);
% x(T_max/2+1:T_max) = cos(0.6*pi*[1:T_max/2]) + ...
%       cos(0.8*pi*[1:T_max/2] + 0.35*pi);
x1_rec = [];
x_hat_rec = [];
err_cnt = 0;
x_hat = zeros(N,1);

Q_hat=randn(N,r);
Q_hat=orth(Q_hat);

Lambda = diag([r:-1:1]/r);

R_hat = Q_hat*Lambda*Q_hat'*0.000000001;
v_0 = randn(N,M);

for m = 1:M,

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v_0(:,m) = v_0(:,m)/norm(v_0(:,m));
end

m_opt = zeros(1,length(x)/N);

for it = 1:length(x)/N,

    x_0 = x(N*(it-1)+1:N*it)';

    %Transmitter search for best search direction

    %Determine how many KLT coefficients to use
    %Q_hat=orth(Q_hat);

    mse = 100;
    y1 = Q_hat'*x_0;

    %update quantization parameters

    rate = rate_0;
    for k = 1:k_max,
        b(k) = max(rate +
0.5*log2(Do(k)/max(prod(Do(1:k_max))^(1/k_max),eval_min)),0);
        b(k) = floor(b(k));
        b(k) = max(b(k),b_min);
        x_fs(k) = nstd*sqrt(Do(k));
    end

    y1 = quant2(y1,b,x_fs,k_max);

    x_hat_old = x_hat;

    k = 1;
    repeats = 0;
    while mse > mse_max & repeats < max_repeats%(used for N = 16)
    % while mse > 1E-5
        x_hat = Q_hat(:,1:k)*y1(1:k);
        mse = norm(x_hat - x_0)^2/norm(x_0)^2;
        k = k + 1;
        if k == k_max+1 & mse > mse_max
            % for m = 2:N,
            % q = Q_hat(:,m);
            % q = q - Q_hat(:,1:m-1)*Q_hat(:,1:m-1)';
            % q = q/norm(q);
            % Q_hat(:,m) = q;
            %
            % end%m
            'missed'
            % k = k_max+1;
            % y1 = Q_hat'*x_0;
            % y1 = quant2(y1,b,x_fs,k_max);
            %mse = 0;

            repeats = repeats + 1;
            x_fs = x_fs_0;
            for k = 1:50,

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        b(k) = (rep_rate-k/50*rep_rate/2);
        %b(k) = rep_rate;
    end
    b = floor(b);
    % b(1:10) = 6;
    % b(11:20) = 4;
    % b(20:64) = 1;
    %B = B + 1;
    y0 = Q_hat'*x_0;
    y1 = quant2(y0,b,x_fs,k_max);
    %norm(y0 - y1)
    if repeats < max_repeats
        k = 1;
    end
end

end

end

r_opt = k-1; %this is the model order
m_opt(it) = r_opt;
for k = r_opt:-1:1,
    if norm(y1(k:r_opt)) == 0
        m_opt(it) = k-1;
    end
end
y1(r_opt+1:N) = zeros(N-r_opt,1);
mo(it) = r_opt;

err= x_hat - x_0;

err_max = 100;
for m = 1:M,
    v = v_0(:,m);
    alpha = v'*err;
    err_v = err - alpha*v;
    if norm(err_v) < err_max
        mvq_opt = m;
        err_hat = alpha*v;
        err_max = norm(err_v);
    %    figure(4)
    %    hold off
    %    plot(err)
    %    hold on
    %    plot(err_hat,'r')
    %    pause(0.001)
    end
end
% x_hat = x_hat + err_hat;
x_frame = [x_hat_old' x_hat'];
for n = 1:N
    x_n = x_frame(n+1:n+N);
    R_hat = lam1*R_hat + x_n*x_n';
end

%R_hat = lam1*R_hat + x_hat*x_hat';

[Vr Dr] = eig(R_hat);
Dr = diag(Dr);

```

```

for n = 1:5
    if abs(imag(Dr(n))) > 0.001
        Dr(n) = 0;
    end
end
[Drs Ir] = sort(Dr);
pow = sum(Drs(2:N));
V = real(Vr);
I = Ir;
Ds = Drs;

for k = 1:r,
    Q_hat(:,k) = V(:,I(N-k+1))/norm(V(:,I(N-k+1)));
end%k

```

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% R_hat = Q_hat*diag(flipud(Ds))*Q_hat';

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%Receiver Processing

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%P_Q =
Q_hat(:,1:r_opt)*inv(Q_hat(:,1:r_opt))*Q_hat(:,1:r_opt)';

% P_Qo =
Qo_hat(:,1:r_opt)*inv(Qo_hat(:,1:r_opt))*Qo_hat(:,1:r_opt)';
% errq(it) = norm(P_Q - P_Qo,'fro');
mse_opt(it) = mse;

if rem(it,1) == 0
    [it r_opt m_opt(it) repeats]
    figure(1)
        hold off
        plot(x_0)
        hold on
        plot(x_hat,'r')
    figure(2)
        hold off
        Do=flipud(Ds)*(1-lam1);
        % [Do_min k_max] = min(abs(Do-0.001));
        plot(real(Do(1:r_opt)))
        hold on
        plot(y1(1:r_opt).*y1(1:r_opt),'r')
    figure(3)
        plot(b)
        pause(0.001);
end

x_hat_rec = [x_hat_rec x_hat'];
bitrate(it) = (sum(b(1:m_opt(it)))+1+log2(N))/(N/sample_rate);

'bitrate:'
[mean(bitrate) bitrate(it)]

end%it

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```
mse_tot = norm(x_hat_rec-  
x(1:length(x_hat_rec)))^2/norm(x(1:length(x_hat_rec)))^2;
```

姓名	性别	年龄	职业	住址	电话	备注
王德胜	男	45	教师	XX路XX号	XXXX	
李小红	女	32	护士	XX街XX号	XXXX	
张小明	男	28	学生	XX村XX组	XXXX	
赵大刚	男	55	工人	XX厂XX车间	XXXX	
刘小芳	女	40	医生	XX医院XX科	XXXX	
陈国强	男	38	工程师	XX公司XX部	XXXX	
周丽娟	女	25	会计	XX单位XX处	XXXX	
吴大伟	男	60	农民	XX乡XX村	XXXX	
孙小梅	女	35	记者	XX报社XX室	XXXX	
郑国强	男	42	律师	XX律所XX楼	XXXX	
王小红	女	22	歌手	XX酒吧XX台	XXXX	
李小明	男	30	程序员	XX公司XX部	XXXX	
张小红	女	33	设计师	XX公司XX部	XXXX	
赵大刚	男	50	司机	XX车队XX班	XXXX	
刘小芳	女	48	清洁工	XX单位XX处	XXXX	
陈国强	男	36	保安	XX单位XX处	XXXX	
周丽娟	女	27	服务员	XX酒店XX部	XXXX	
吴大伟	男	58	快递员	XX公司XX部	XXXX	
孙小梅	女	31	销售员	XX公司XX部	XXXX	
郑国强	男	44	采购员	XX公司XX部	XXXX	
王小红	女	24	实习生	XX公司XX部	XXXX	
李小明	男	29	技术员	XX公司XX部	XXXX	
张小红	女	34	质检员	XX公司XX部	XXXX	
赵大刚	男	52	维修工	XX公司XX部	XXXX	
刘小芳	女	46	培训师	XX公司XX部	XXXX	
陈国强	男	39	培训师	XX公司XX部	XXXX	
周丽娟	女	26	培训师	XX公司XX部	XXXX	
吴大伟	男	59	培训师	XX公司XX部	XXXX	
孙小梅	女	32	培训师	XX公司XX部	XXXX	
郑国强	男	43	培训师	XX公司XX部	XXXX	
王小红	女	23	培训师	XX公司XX部	XXXX	
李小明	男	28	培训师	XX公司XX部	XXXX	
张小红	女	33	培训师	XX公司XX部	XXXX	
赵大刚	男	51	培训师	XX公司XX部	XXXX	
刘小芳	女	45	培训师	XX公司XX部	XXXX	
陈国强	男	37	培训师	XX公司XX部	XXXX	
周丽娟	女	25	培训师	XX公司XX部	XXXX	
吴大伟	男	57	培训师	XX公司XX部	XXXX	
孙小梅	女	30	培训师	XX公司XX部	XXXX	
郑国强	男	41	培训师	XX公司XX部	XXXX	
王小红	女	21	培训师	XX公司XX部	XXXX	
李小明	男	26	培训师	XX公司XX部	XXXX	
张小红	女	31	培训师	XX公司XX部	XXXX	
赵大刚	男	49	培训师	XX公司XX部	XXXX	
刘小芳	女	43	培训师	XX公司XX部	XXXX	
陈国强	男	35	培训师	XX公司XX部	XXXX	
周丽娟	女	24	培训师	XX公司XX部	XXXX	
吴大伟	男	56	培训师	XX公司XX部	XXXX	
孙小梅	女	29	培训师	XX公司XX部	XXXX	
郑国强	男	40	培训师	XX公司XX部	XXXX	
王小红	女	20	培训师	XX公司XX部	XXXX	
李小明	男	25	培训师	XX公司XX部	XXXX	
张小红	女	30	培训师	XX公司XX部	XXXX	
赵大刚	男	48	培训师	XX公司XX部	XXXX	
刘小芳	女	42	培训师	XX公司XX部	XXXX	
陈国强	男	34	培训师	XX公司XX部	XXXX	
周丽娟	女	23	培训师	XX公司XX部	XXXX	
吴大伟	男	55	培训师	XX公司XX部	XXXX	
孙小梅	女	28	培训师	XX公司XX部	XXXX	
郑国强	男	39	培训师	XX公司XX部	XXXX	
王小红	女	19	培训师	XX公司XX部	XXXX	
李小明	男	24	培训师	XX公司XX部	XXXX	
张小红	女	29	培训师	XX公司XX部	XXXX	
赵大刚	男	47	培训师	XX公司XX部	XXXX	
刘小芳	女	41	培训师	XX公司XX部	XXXX	
陈国强	男	33	培训师	XX公司XX部	XXXX	
周丽娟	女	22	培训师	XX公司XX部	XXXX	
吴大伟	男	54	培训师			